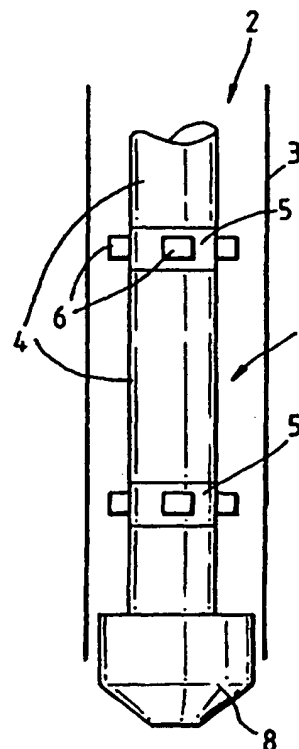


PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification : Not classified	A2	(11) International Publication Number: WO 00/41487 (43) International Publication Date: 20 July 2000 (20.07.00)
(21) International Application Number: PCT/GB00/00029 (22) International Filing Date: 7 January 2000 (07.01.00) (30) Priority Data: 333681 11 January 1999 (11.01.99) NZ (71) Applicant (for all designated States except US): WEATHER-FORD U.S., L.P. [US/US]; 515 Post Oak Boulevard, Houston, TX 77027 (US). (71) Applicant (for GB only): HARDING, Richard, Patrick [GB/GB]; 4220 Nash Court, Oxford Business Park South, Oxford OX4 2RU (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): MURRAY, Geoffrey, Neil [US/US]; 14840 Oak Shores Drive, Willis, TX 77318 (US). (74) Agent: HARDING, Richard, Patrick; Marks & Clerk, 4220 Nash Court, Oxford Business Park South, Oxford OX4 2RU (GB).		(81) Designated States: AU, CA, GB, NO, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>Without international search report and to be republished upon receipt of that report.</i>
(54) Title: A PIPE ASSEMBLY AND LUBRICATING METHOD (57) Abstract A pipe assembly (5) for use in a wellbore (3) having a plurality of outlets (6) positioned about the periphery of the pipe at longitudinally spaced apart intervals for allowing fluid to pass from the interior to the exterior of the pipe.		



BEST AVAILABLE COPY

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

A PIPE ASSEMBLY AND LUBRICATING METHOD

The present invention relates to a pipe assembly incorporating means for lubricating a section of pipe as it is run into a well bore. The pipe may be casing liner, drillpipe, tubing or coil tubing. The invention also relates to a method of running in a section of pipe.

When a section of casing is run into a well it is common to employ lubricants to reduce the friction between the outer wall of the casing and the wall of the well. Typically, lubricants are pumped between the outer wall of the casing and the wall of the well. Such lubricants effectively provide only static lubrication. Once the casing is moving relative to the well the lubricants can provide effective lubrication. However, when movement is first initiated the lubricants may not provide effective lubrication and the starting torque to initiate movement of the casing string may be greater than the limits of the rig or the casing connections.

According to a first aspect of the invention, there is provided a pipe assembly for use in a wellbore having a plurality of outlets positioned about the periphery of the pipe at longitudinally spaced apart intervals for allowing fluid to pass from the interior to the exterior of the pipe.

The outlets may have fluid communication passages between the interior of the pipe and orifices of the outlets to convey fluid from within the pipe to the outlet orifices.

The pipe may be casing, liner, drill pipe, tubing or coil tubing. The outlets preferably include one way valves to ensure that fluid may only flow from the interior of the pipe out of the outlets and not in the return direction. A further non return valve may be provided in each outlet, activated by a fusible link, which prevents flow from the interior of the pipe out of the outlets when activated. The fusible link may be actuated by an acid or alkaline pill.

The outlets may preferably be provided on sub-sections joining sections of pipe. The outlets may include flexible seals provided about the outlet orifices.

There is further provided a method of running a section of pipe in a well bore comprising running a pipe assembly having outlets positioned about the periphery of the pipe at spaced apart intervals in the wellbore, and supplying lubricating fluid to the interior of the pipe at a sufficient pressure to cause lubricating fluid to exit from the outlets so as to provide effective hydrodynamic friction reduction between the pipe assembly and the wall of the well.

Preferably the pipe assembly includes a non-return valve that is actuated by a fusible link and after the casing is run and acid or alkaline pill is introduced into the interior of the pipe assembly to break the fusible link to actuate the non-return valve to prevent fluid flowing through the outlets.

A preferred embodiment of the invention will now be described by way of example only and with reference to the accompanying drawings in which:

Figure 1 shows a schematic diagram of a casing assembly incorporating friction reduction means;

Figure 2 shows a cross-sectional view through a section of the casing assembly shown in figure 1; and

Figure 3 shows a cross-sectional view of an outlet of the casing assembly shown in figures 1 and 2.

Referring to figures 1 and 2 a casing assembly 1 is shown within a well 2 having a wall 3. The casing assembly 1 consists of casing sections 4 joined together by sub-sections 5. A plurality of outlets 6 are provided about the periphery of sub-sections 5 which expel lubricating fluid supplied under pressure via the interior of sections 4 and 5. A float shoe 8 is shown connected to the bottom of the casing assembly 1.

Referring now to figure 3 an outlet 6 is shown in greater detail. The outlet has a threaded end 9 which screws into a corresponding threaded bore within a respective sub-section 5. Plate 10 has an aperture 11 therein to control the fluid supplied to an outlet 6. The apertures 11 may be differently sized at different depths to achieve the desired fluid distribution along the length of the casing assembly.

Fluid from the interior of sub-section 5 may flow through aperture 11 through passage 12 and out via orifice 13. A flexible seal 14 may be provided about orifice 13 to assist in assuring hydrodynamic lubrication between the orifice and the well wall 3.

Non-return valve 15 ensures that fluid can only flow in a direction from aperture 11 to orifice 13 and not in the return direction. Non-return valve 16 is retained in a normally open position by a fusible link 17. Fusible link 17 may be broken by an acid or alkaline pill to cause the valve to close and prevent fluid flow in the direction from aperture 11 to orifice 13.

In use, float shoe 8 is initially closed and the casing assembly 1 is run down well bore 4. During this operation lubricating fluid is supplied to the interior of casing section 4 and sub-section 5 under pressure. Lubricating fluid from sub-sections 5 flows out through outlet 6 to create hydrodynamic lubrication between the casing assembly and the wall 3 of well 2. This greatly reduces friction between the casing assembly 1 and the wall 3 of well 2 both during start-up and as the casing assembly 1 is run into position. This reduces the load on connections between sections of casing as well as the power of the rig required to run the casing.

Once the casing has been run to a desired position an acid or alkaline pill is introduced into the lubricating fluid to be conveyed to the outlets 6. The alkaline or acid environment causes the links 7 to break, causing valves 16 to close due to the action of fluid pressure or under biasing from a biasing means.

The float shoe 8 is then opened. This is typically achieved by sending a steel ball through the inside of casing assembly 1 to impact and open float shoe 8. Thus material pumped down casing 1 may exit via the float shoe only and not via outlet 6.

The casing assembly 1 is then cleaned and cement is then pumped down the casing under pressure which forces up to fill the spaces between casing assembly 1 and the wall 3 of the well 2. The cement is followed by a drillable plug, formed of a material such as phenolic, aluminium or gun metal. The plug is forced to the bottom of the casing assembly to force the cement out of the casing assembly 1. The plug may subsequently be drilled when the next stage of drilling is carried out.

To ensure that fluid is supplied to the locations most requiring lubrication outlets 6 may include gravity valves so that fluid is supplied when the casing assembly 1 is substantially upright or the outlet is on the downward side of the casing assembly 1 (when running along a lateral) but not when the outlet is on the upper side of the casing assembly 1 (when running along a lateral). This ensures that lubricating fluid is supplied only to those outlets resting against the wall of the well.

Although the invention has been described in relation to an embodiment in which sections of casing 4 are interconnected via subsections 5, it is to be appreciated that outlets could be provided directly from casing sections 4. The use of sub-sections 5 is preferred as this enables standard casing to be used without modification.

It will also be appreciated that the invention may be applied to liner, drill pipe, or coil tubing with obvious modifications.

Where in the foregoing description reference has been made to integers or components having known equivalents then such equivalents are herein incorporated as if individually set forth.

Although this invention has been described by way of example it is to be appreciated that improvements and/or modifications may be made thereto without departing from the scope of the present invention.

CLAIMS:

1. A pipe assembly for use in a wellbore having a plurality of outlets positioned about the periphery of the pipe at longitudinally spaced apart intervals for allowing fluid to pass from the interior to the exterior of the pipe.
2. A pipe assembly as claimed in claim 1, comprising fluid communication passages between the interior of the pipe and external orifices of the outlets to convey fluid from within the pipe to the external orifices.
3. A pipe assembly as claimed in claim 1 or 2, wherein the outlets comprise one way valves arranged such that fluid may only flow from the interior to the exterior of the pipe.
4. A pipe assembly as claimed in claim 1, 2 or 3, wherein each outlet comprises a non-return valve activatable by a fusible link which prevents fluid flow from the interior to the exterior of the pipe when activated.
5. A pipe assembly as claimed in claim 4, wherein the non-return valve is activated by a fusible link being broken by the action of an acid or alkaline pill.
6. A pipe assembly as claimed in any preceding claim, wherein the outlets are provided on sub-sections joining sections of pipe.
7. A pipe assembly as claimed in any preceding claim, wherein the outlets include flexible seals provided around external orifices.
8. A pipe assembly as claimed in any preceding claim, wherein the pipe assembly is a casing assembly.
9. A method of running a section of pipe in a wellbore comprising running a pipe assembly having outlets positioned around the periphery of the pipe at spaced apart intervals in the wellbore, and supplying lubricating fluid to the interior of the pipe at

sufficient pressure to cause the lubricating fluid to exit from the outlets so as to provide hydrodynamic friction reduction between the pipe assembly and the wall of the wellbore.

10. A method as claimed in claim 10, wherein the outlets have a non-return valve actuated by a fusible link, and further comprising introducing an acid or alkaline pill into the interior of the pipe assembly after the pipe assembly is run, the acid or alkaline pill breaking the fusible link and thereby actuating the non-return valve to prevent fluid flowing through the outlets.

1/1

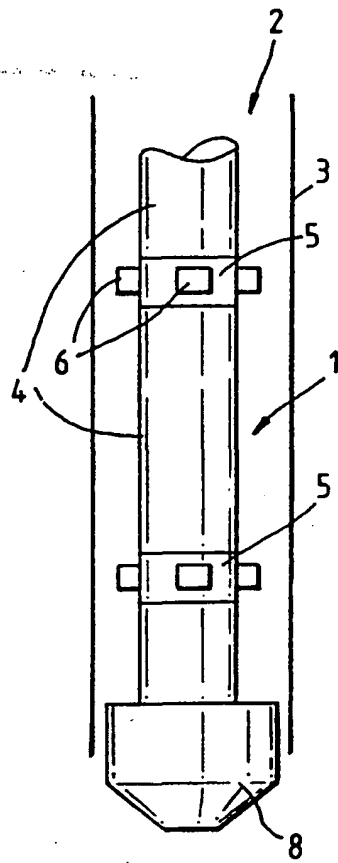


Fig. 1

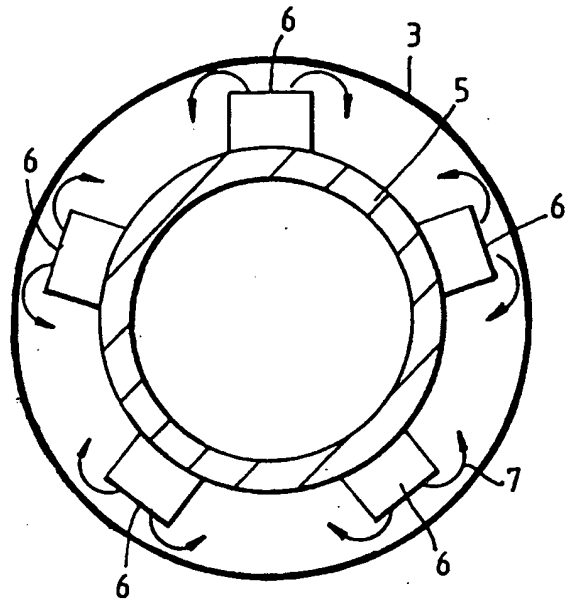


Fig. 2

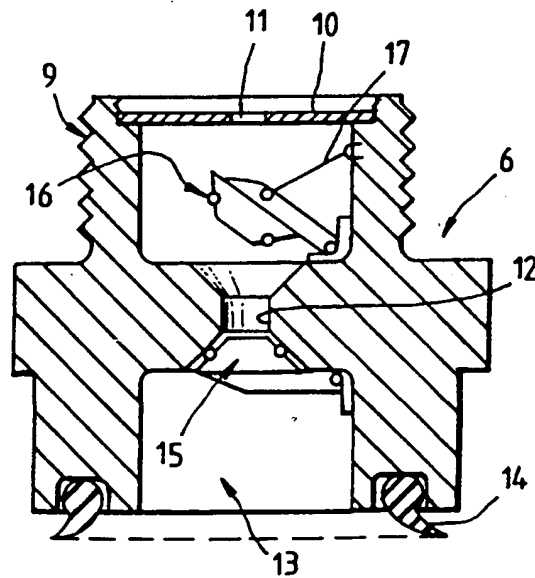


Fig. 3

THIS PAGE BLANK (USPTO)

THIS PAGE BLANK (USPTO)

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

THIS PAGE BLANK (USPTO)